IN THE CLAIMS

We claim:

1. (Currently amended) A process for separating an inlet gas stream containing methane and lighter components, C2 components, C3 components and heavier hydrocarbons into a more volatile gas fraction containing substantially all of the methane and lighter components and a less volatile hydrocarbon fraction containing a major portion of C2 components, C3 components and heavier hydrocarbons, the process comprising the steps of:

(a) cooling and partially condensing a feed gas stream having a feed gas pressure to provide a cooled feed stream;

(b) separating the cooled feed stream into a first vapor stream and a first liquid stream;

(c) splitting the first vapor stream into a first gas streamand a second gas stream;

(d) expanding the first gas stream to a low pressure so that the first gas stream forms a lower tower feed stream;

(e) supplying [the] a fractionation tower with the lower tower feed stream, a first tower feed stream, and a second tower feed stream, the fractionation tower separating the lower tower feed stream, the first tower feed stream, and the second tower feed stream into a tower bottoms stream and a tower overhead stream;

(f) warming the tower overhead stream to produce a residue gas stream; and

(g) wherein an improvement includes:

i) supplying an absorber tower containing one or more mass transfer stages with the second gas stream as a lower absorber feed stream;

ii) cooling the first liquid stream to produce a substantially condensed first liquid stream and supplying the absorber tower with the substantially condensed first liquid stream as a top absorber feed stream, the absorber tower producing an absorber overhead stream and an absorber bottoms stream;

iii) cooling and thereby substantially condensing the absorber overhead stream to produce the first tower feed stream; and

iv) maintaining quantities and temperatures of the first and second tower feed streamsso that a tower overhead temperature of the tower overhead stream is maintained and a major portion of the C2 components, C3 components and heavier hydrocarbons is recovered in the tower bottoms stream.

2. (Original) The process of claim 1, wherein the improvement further includes the step of cooling the absorber bottoms stream to produce the second tower feed stream.

3. (Original) The process of claim 1, further including the step of cooling the second gas stream prior to supplying the absorber tower with the second gas stream.

4. (Original) The process of claim 1, wherein the improvement further includes providing recovery of ethane in excess of about 96% and recovery of propane in excess of about 99.5%.

5. (Original) The process of claim 1, further including the steps of:

(a) expanding the second gas stream and at least a portion of the substantially cooled first liquid stream to an intermediate pressure between the feed gas pressure and the low pressure; and

(b) operating the absorber tower at the intermediate pressure.

6. (Original) The process of claim 1, further including the step of expanding the second liquid stream to the low pressure to produce an expanded second liquid stream and directing the expanded second liquid stream to the distillation tower at a feed location below the expanded first vapor stream.

7. (Original) The process of claim 1, wherein the steps of warming the tower overhead stream, cooling the first liquid stream, cooling and thereby substantially condensing the absorber overhead stream, and cooling the absorber bottoms stream are performed by heat exchange contact with a process stream selected from the group consisting of the tower overhead stream, the first liquid stream, the absorber overhead stream, the absorber bottoms stream, and combinations thereof.

8. (Original) A process for separating an inlet feed gas stream containing methane and lighter components, C2 components, C3 components and heavier hydrocarbon components into a more volatile fraction containing the methane and lighter components and a less volatile fraction containing a major portion of C2 components, C3 components and heavier hydrocarbons, the process comprising the steps of:

(a) cooling and partially condensing an inlet feed gas stream having a feed gas pressure to provide a cooled feed stream;

(b) separating the cooled feed stream into a first vapor stream and a first liquid stream;

(c) splitting the first vapor stream into a first gas stream and a second gas stream;

(d) expanding the first gas stream to a lower pressure so that the first gas streamforms a lower tower feed stream;

(e) supplying a fractionation tower with the lower tower feed stream, a first tower feed stream, and a second tower feed stream, the fractionation tower separating the lower tower feed stream, the first tower feed stream, and the second tower feed stream into a tower bottoms stream containing a major portion of the C2 components, C3 components and heavier hydrocarbons and a tower overhead stream;

(f) warming and compressing the tower overhead stream to produce a residue gas stream;

(g) wherein an improvement comprises the steps of:

i) supplying an absorber tower containing one or more mass transfer stages with the second gas stream as a lower absorber feed stream;

ii) cooling the first liquid stream to form a substantially cooled first liquid stream and supplying the absorber tower with the first liquid stream as a top absorber

feed stream, the absorber tower producing an absorber overhead stream and an absorber bottoms stream;

iii) cooling the absorber overhead streamso that at least a portion of the absorber overhead stream is substantially condensed to produce the first tower feed stream;

iv) splitting the residue gas stream into a residue recycle stream and volatile residue gas stream;

v) cooling and thereby substantially condensing the residue recycle streamprior to returning the residue recycle stream to the fractionation tower; and

vi) maintaining quantities and temperatures of the first and second tower feed streams so that a tower overhead temperature of the tower overhead stream is maintained and a major portion of the C2 components, C3 components and heavier hydrocarbons is recovered in the tower bottoms stream.

9. (Original) The process of claim 8, wherein the improvement further includes the step of cooling the absorber bottoms stream so that at least a portion of the absorber bottoms stream is substantially condensed to produce the second tower feed stream.

10. (Original) The process of claim 8, further including the step of cooling the second gas stream prior to introduction into the absorber tower.

11. (Original) The process of claim 8, wherein the improvement further includes providing recovery of ethane in excess of about 96% and recovery of propane in excess of about 99.5%.

12. (Original) The process of claim 8, further including the steps of:

(a) expanding the second gas stream and at least a portion of the substantially cooled first liquid stream to an intermediate pressure between the feed gas pressure and the lower pressure; and

(b) operating the absorber tower at the intermediate pressure.

13. (Original) The process of claim 8, further including the steps of:

(a) cooling and expanding the second gas stream to an intermediate pressure between the feed gas pressure and the lower pressure;

(b) substantially cooling and expanding at least a portion of the substantially cooled first liquid stream to the intermediate pressure; and

(c) operating the absorber tower at the intermediate pressure.

14. (Original) The process of claim 8, further comprising the step of expanding the second tower feed stream to the lower pressure and directing the second tower feed stream to the distillation tower at a feed location below the lower tower feed stream.

15. (Original) The process of claim 8, wherein the steps of warming the tower overhead stream, cooling the first liquid stream, cooling and thereby substantially condensing at least a portion of the

absorber overhead stream, and cooling the absorber bottoms stream are performed by heat exchange contact with a process stream selected from the group consisting of the tower overhead stream, the first liquid stream, the absorber overhead stream, the absorber bottoms stream, and combinations thereof.

16. (Original) A process for separating a feed gas stream containing methane and lighter components, C2 components, C3 components and heavier hydrocarbon components into a more volatile fraction containing the methane and lighter components and a less volatile fraction containing a major portion of C2 components, C3 components and heavier hydrocarbons, the process comprising the steps of:

(a) splitting a feed gas stream into a first feed gas stream and a second feed gas stream;

(b) cooling and partially condensing the first feed gas stream to produce a cooled feed stream;

(c) separating the cooled feed stream into a first vapor stream and a first liquid stream;

(d) expanding the first vapor stream to a low pressure to produce a lower tower feed stream;

(e) supplying a fractionation tower with the lower tower feed stream, a first tower feed stream, and a second tower feed stream, the fractionation tower separating the lower tower feed stream, the first tower feed stream, and the second tower feed stream into a tower bottoms stream and a tower overhead stream;

(f) warming the tower overhead stream to produce a residue gas stream; and

(g) wherein an improvement includes:

i) supplying an absorber tower containing one or more mass transfer stages with the second feed gas stream as a lower absorber feed stream;

ii) cooling the first liquid stream to form a substantially cooled first stream and supplying the absorber tower with the substantially cooled first liquid stream as a top absorber feed stream, the absorber tower producing an absorber overhead streamand an absorber bottoms stream;

cooling the absorber overhead stream so that at least a portion of the absorber overhead stream is substantially condensed to produce the first tower feed stream; and

iii) maintaining quantities and temperatures of the first and second tower feed streams so that a tower overhead temperature of the tower overhead stream is maintained and a major portion of the C2 components, C3 components and heavier hydrocarbons is recovered in the tower bottoms stream.

17. (Original) The process of claim 16, wherein the improvement further includes the step of cooling the absorber bottoms stream so that at least a portion of the absorber bottoms stream is substantially condensed to produce the second tower feed stream.

18. (Original) The process of claim 16, further including the step of cooling the second feed gas stream prior to introduction into the absorber tower.

19. (Original) The process of claim 16, wherein the improvement further includes providing recovery of ethane in excess of about 96% and recovery of propane in excess of about 99.5%.

20. (Original) The process of claim 16, further including the steps of:

(a) cooling and expanding the second feed gas stream to an intermediate pressure between the feed gas pressure and the low pressure;

(b) substantially cooling and expanding at least a portion of the substantially cooled first liquid stream to the intermediate pressure; and

(c) operating the absorber tower at the intermediate pressure.

21. (Original) The process of claim 16, further including the step of expanding the second condensed stream to the lower pressure and directing the expanded second condensed stream to the distillation tower at a feed location below the expanded first vapor stream.

22. (Original) The process of claim 16, wherein the steps of warming the tower overhead stream, cooling the first liquid stream, cooling and thereby substantially condensing at least a portion of the absorber overhead stream, and cooling the absorber bottoms stream are performed by heat exchange contact with a process stream selected from the group consisting of the tower overhead stream, the first liquid stream, the absorber overhead stream, the absorber bottoms stream, and combinations thereof.

23. (Original) An apparatus for separating an inlet gas stream containing methane and lighter components, C2 components, C3 components and heavier hydrocarbons into a more volatile gas fraction containing substantially all of the methane and lighter components and a less volatile hydrocarbon fraction containing a major portion of C2 components, C3 components and heavier hydrocarbons, the apparatus comprising:

(a) a first cooler for cooling and partially condensing a feed gas stream having a feed gas pressure to provide a cooled feed stream;

(b) a first separator for separating the cooled feed stream into a first vapor stream and a first liquid stream;

(c) a first expander for expanding the first vapor stream to a low pressure so that the first vapor stream forms a lower tower feed stream;

(d) a fractionation tower for receiving the lower tower feed stream, a first tower feed stream, and a second tower feed stream and for separating the lower tower feed stream, the first tower feed stream, and the second tower feed stream into a tower bottoms stream and a tower overhead stream;

(e) a first heater for warming the tower overhead stream to produce a residue gas stream;

(f) an absorber tower containing one or more mass transfer stages for receiving a second gas stream as a lower absorber feed stream;

(g) a second cooler for cooling the first liquid stream to produce a substantially condensed first liquid stream and supplying the absorber tower with the substantially condensed first liquid stream as a top absorber feed stream, the absorber tower producing an absorber overhead stream and an absorber bottoms stream; and

(h) a third cooler for cooling and thereby substantially condensing the absorber overhead stream to produce the first tower feed stream.

24. (Original) The apparatus of claim 23, further including a fourth cooler for cooling the absorber bottoms stream to produce the second tower feed stream.

25. (Original) The apparatus of claim 23, further including a fifth cooler for cooling the second gas stream prior to introduction into the absorber tower.

26. (Original) The apparatus of claim 25, further including a second expander for expanding the second gas stream and at least a portion of the substantially cooled first liquid stream prior to introduction into the absorber tower.

27. (Original) The apparatus of claim 23, further comprising a first compressor for compressing the tower overhead stream prior to producing the residue gas stream.

28. (Original) The apparatus of claim 23, wherein the first heater, the second cooler, the third cooler and the fourth cooler comprise a single heat exchanger that is capable of performing each duty separately performed by each exchanger.